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1 RECORD OF ORAL HEARING
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3 UNITED STATES PATENT AND TRADEMARK OFFICE
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6 BEFORE THE BOARD OF PATENT APPEALS
7 AND INTERFERENCES
8

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10 Ex parte SUNDAR NARAYANAN
11 and KRISHNASWAMY RAMKUMAR
12

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14 Appeal 2008-4017
15 Application 09/975,257
16 Technology Center 2800
17

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19 Oral Hearing Held: Wednesday, October 22, 2008
20

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23 Before BRADLEY R. GARRIS, PETER F. KRATZ, and
24 MICHAEL P. COLAIANNI, Administrative Patent Judges
25

26 ON BEHALF OF THE APPELLANTS:

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1 The above-entitled matter came on for hearing on Wednesday,
2 October 22, 2008, commencing at 1:40 p.m., at the U.S. Patent and
3 Trademark Office, 600 Dulany Street, 9th Floor, Hearing Room D,
4 Alexandria, Virginia, before Kevin Carr, Notary Public.

5 JUDGE KRATZ: Good afternoon, Mr. Kelber.

6 MR. KELBER: Good afternoon, Your Honors. Thank you for
7 this opportunity to address the Board. This is calendar number 28 and the
8 application is 09/975,257.

9 The invention and the principal reference in this case as you see
10 are very closely related. The -- without dwelling on the background of the
11 technology, the invention addresses a quality control issue in manufacturing
12 lines for semiconductors.

13 And that is the thickness and the placing of a nitrided protective
14 layer for a gate electrode. The amount of nitrogen present and its placement
15 relative to the gate itself is a critical issue and presents a variety of quality
16 control issues.

17 As I said, the principal reference although it's brief and doesn't
18 tell us a lot about why it should work, is very, very close. And there's no
19 sense just belaboring the point that the Yasushi reference does in fact
20 describe forming a nitride protective layer.

21 It does in fact re-oxidize that protective layer. There are two
22 important differences or one important difference and one silence and really
23 that's what I want to focus primarily on today.

24 The important difference: the claims specify nitric oxide, NO as
25 the source for the nitrogen for the nitrided layer. The reference specifies
26 nitrous oxide.

1 That's an important difference and the Examiner recognized
2 that early on and the Examiner relies on a secondary reference, U.S. Patent
3 6,372,581, Bensahel to supply that teaching.

4 We suggest to you that the reliance on that secondary reference
5 is not in accordance with the standards of 35 U.S.C. 103. Bensahel does in
6 fact describe nitride in using both nitrous and nitric oxide.

7 But the reference doesn't suggest that you can substitute one for
8 the other. And in fact, quite to the contrary Bensahel teaches those of
9 ordinary skill in the art that nitrided layers prepared from nitrous oxide, the
10 source of the Yasushi layer are plagued with a variety of problems.

11 And that prior art layers formed from nitric oxide are also
12 phased with a variety of problems and that instead, to get a good nitrided
13 layer you need to use nitric oxygen -- nitric oxide, sorry, at a very low
14 temperature, what is a relatively low temperature.

15 Temperature is not going above 700 degrees C. That's
16 important because both the principal reference, the claims, and the rest of the
17 art relied upon as well as the teaching of another reference USEF that's a
18 record in this case, focus on the use of high temperatures RTP 900 degrees
19 and above.

20 You wouldn't substitute the nitric oxide layer of Bensahel for
21 the nitrous oxide layer of Yasushi because Yasushi specifically requires
22 although we don't know many details of that principal reference, specifically
23 requires 900 degrees C for the re-oxidizing temperature.

24 And that's a condition very similar to the conditions set forth in
25 the current claims. So there are not equipped ones. One wouldn't go into
26 the secondary reference to select out nitrous -- I'm sorry, nitric oxide to put
27 it in the nitrous oxide.

1 One would go one way with one process with low temperatures
2 which is not a great process for a high speed production because of the low
3 temperature as Wolfe teaches us, and that's a tertiary reference if you will.

4 The high temperatures that are consistent with RTP processing
5 allow for high speed manufacturing. That's Yasushi, that's Wolf, that's the
6 claimed invention. That's not Bensahel.

7 KSR made it a lot -- KSR decreased the need to find a specific
8 reference for combination of the teachings of reference A with the teachings
9 of reference B.

10 If you've got all the limitations and they would do what is
11 expected by the reference in combination KSR says that may be enough.

12 But KSR did not eliminate the requirement that we consider the
13 teachings as a whole. That fourth reference that I mentioned teaches us
14 something else.

15 It specifically teaches us that nitrous oxide and nitric oxide
16 sourced nitrided layers are different. They're different in composition and
17 they're different in the way they migrate under application of heat and that's
18 the second thing I wanted to talk with you about.

19 Because the Yasushi is silent and the Examiner acknowledges
20 that silence with respect to a limitation of all the independent claims that
21 were rejected and that is when you oxidize or some people say re-oxidize
22 this nitrided layer, you distance the nitrided gate oxide layer from the
23 substrate interface itself.

24 That's an important processing step because although the
25 nitrogen layer, the nitrided layer is there to protect against dopant
26 penetration, the presence of nitrogen at that interface is itself an adverse
27 dopant or a poison to the construction of that mosfat.

1 And so it matters according to USEF what source you chose
2 and it matters according to the claims because, while again we don't know a
3 whole lot about the processing conditions where Yasushi is silent on what
4 happens to that nitrided layer Wolf will teach you and Bensahel describes a
5 process that puts the nitrided protective layer adjacent to the interface almost
6 atomic face distance.

7 And that's the important thing. That's why USEF is relied
8 upon by applicants here because they do teach that that's a property of the
9 nitrous oxide generated layers but that nitric oxide layers have the opposite
10 motion.

11 They move away. Well, the Examiner says it would be
12 inherent. Inherency is a problem I think in an obviousness rejection of this
13 type where you're combining high temperatures and low temperatures or
14 you're combining source A and source B because there's no way for
15 Appellants here to duplicate whatever it is the Examiner has in mind and
16 show that it is or is not the same result.

17 Inherency is typically the standard in an anticipation rejection.
18 But what we do know is that temperature matters and source matters.

19 A nitric oxide, according to the references, source nitrided layer
20 on re-oxidation will not always move, distance itself from that interface.

21 A nitrous oxide sourced layer, when treated at the temperatures
22 the principal reference calls for, 900 degrees will move toward the surface,
23 the semiconductor substrate surface.

24 So it's not inherent. It depends on what set of conditions you
25 choose. And the law on inherency tells us that it has to happen all the time.

26 There are minor differences in some of the claims and a minor
27 difference in the principal reference which mentions thickness and therefore

1 nitrogen content on the rate of nitrogen formation rather than the actual
2 thickness versus a database thickness for claims 19 and 23.

3 But truly they are trivial compared to this major difference.
4 One last note on the combination of references cited by the Examiner;
5 Bensahel doesn't talk about re-oxidation.

6 And that's the problem because the reference, the primary
7 reference in the claims are along the first point and the second point the
8 same except for that source of nitrous.

9 JUDGE KRATZ: That primary reference doesn't really seem
10 to indicate while there is only one source, it doesn't seem to indicate that
11 that's critical to that.

12 MR. KELBER: I think that that's accurate. It doesn't indicate
13 criticality or absence of criticality. I believe the nitrous and nitric oxide
14 sources were being used for protection. So if in fact you could use it
15 according to the principal reference I think that it would fault that.

16 JUDGE KRATZ: And is there a technical reason why you
17 think that that would be the case, that it is in the reference?

18 MR. KELBER: Nitrous oxide is a lot easier to work with from
19 the point of view of speed. That's not in the reference. It's in Wolf. Speed
20 is the dominant issue in the formation of thin film semiconductors.

21 But that's a guess. That's not specifically taught by any of the
22 references. The -- there is an interesting passage in Wolf, though, that
23 might give some insight on that.

24 And that is that -- and this is -- I'm sorry, this is on page 269 of
25 Wolf -- I'm sorry, I've done it again. That's page 269 of USEF. I think
26 that's the right pronunciation and that's page 269 in the left hand column.

1 And it indicates that as opposed to nitrous oxide annealed films,
2 the nitric oxide annealed film has a much higher concentration of nitrogen
3 near the interface. Remember that's a blessing and a curse.

4 If you use nitric oxide you get more nitrogen. That's not hardly
5 a chemical surprise but you get it where you really don't want it and unless
6 you, like the claims recognize that you can solve that problem by re-
7 oxidizing at a -- re-oxidizing the nitrided layer to move it, to distance it from
8 that interface.

9 I think that's a disincentive to one of skill in the art to use it.

10 JUDGE KRATZ: Now your own Specification indicates that it
11 could go toward or away, right?

12 MR. KELBER: It indicates both and it indicates that there's --

13 JUDGE KRATZ: The edge is to each.

14 MR. KELBER: Yeah, it does indicate that with nitric oxide the
15 re-oxidation process should distance the nitrided layer away and with nitrous
16 oxide -- it doesn't specify which one.

17 It says you can do one or the other. You can drive it toward the
18 interface.

19 JUDGE KRATZ: Toward or away.

20 MR. KELBER: And I think given USEF, given Wolf, what
21 you're seeing is a failure to repeat that if you use nitrous oxide you keep the
22 protective layer close to the interface which the application talks about.

23 If you use nitric oxide on re-oxidation you distance it on the
24 interface. In terms of processing advantages, what's being claimed here is
25 the left hand side, the nitric oxide.

26 JUDGE KRATZ: So basically you are disclosing either one as
27 an advantage and as a disadvantage to some extent.

1 MR. KELBER: They both have disadvantages to some extent.
2 That's correct.

3 JUDGE KRATZ: Which would have been recognized by the
4 prior reference standard?

5 MR. KELBER: I'm sorry, recognized?

6 JUDGE KRATZ: Based on USEF as you stated?

7 MR. KELBER: USEF recognizes the same difference in
8 patterns, yes. But what it teaches is that they are not substitutes, not that
9 they are substitutes.

10 So if you take a reference, a primary reference that says I want
11 nitrous oxide then your goal or the ability to manipulate that layer on re-
12 oxidation is already set.

13 And you're going to follow that right hand of teachings which
14 says, okay, you have a lower nitrogen content, you have it closer to the
15 interface.

16 You're not going to go to a reference that says go the other
17 way.

18 JUDGE KRATZ: The primary goal though was really just to
19 measure the amount of nitrogen in the layer.

20 MR. KELBER: That is the absolute goal of both references.

21 JUDGE KRATZ: Of both references?

22 MR. KELBER: Yes; of both the claims and the --

23 JUDGE KRATZ: And it is a subsidiary thing that you can go
24 toward or away depending on which one you use so --

25 MR. KELBER: I don't want to say it's a subsidiary thing
26 whether you go toward or away. It's an important thing. It's a processing
27 element.

1 What the application points out fairly consistently throughout is
2 that this does -- this is not a cure for the common cold. This is not a new
3 paradigm in making semiconductor gates.

4 But it points out that the problem is these things are in a line.
5 These things are going forward. You can't use the existing technology, the
6 Sims Measurement technology in that environment so you've got to find
7 another way.

8 So this allows you to continue processing and do an important
9 processing step which is properly locate the nitrided layer that has been re-
10 oxidized.

11 JUDGE KRATZ: Which is the same thing that the Yasushi was
12 directed towards to, I believe.

13 MR. KELBER: The Yasushi reference would probably direct --
14 - if you follow the 900 degrees re-oxidation and you have the other step, the
15 other conditions proper, the Yasushi is probably going to do the opposite
16 thing because it uses nitrous oxide.

17 The references will tell us you can go the other way.

18 JUDGE KRATZ: But they're trying to get away from the Sims
19 as well too. The same problems include the -- they're trying to get away
20 from Sims by --

21 MR. KELBER: Well, you've got a choice of what problem you
22 want to pick.

23 JUDGE KRATZ: Yes.

24 MR. KELBER: And I think it's fair to say that the working
25 environment of the application and the introduction of the application
26 teaches you these are choices you have to make.

27 These are not choices that the prior art that is cited lead you to.

1 JUDGE KRATZ: A quick technical matter; this Yasushi
2 reference. We have two different translations of record and one lists the
3 name as Iwata, Hiroshi Iwata, the other listed as Yasushi.

4 You're aware of that, right?

5 MR. KELBER: Yes. My understanding from speaking with
6 the Examiner, it's not a record interview. It's the machine translation which
7 has some additional information in it is what is being relied on.

8 And it is the machine translation that actually tells us what the
9 conditions for re-oxidation to be used are that allow you to conclude that's
10 not right for Bensahel.

11 JUDGE GARRIS: Where is the disclosure in the machine
12 translation? Can you point it out to us please?

13 MR. KELBER: The conditions? That's -- it's just about in the
14 middle of what is the second page of the machine translation. I'd just read it
15 to you.

16 If you look at the left hand column it starts out with 0.0191 and
17 then it says "and the N₂O flow rate of a re-oxidation rate are 5 SLM and
18 processing temperature/900 degrees C" which is consistent with the RTP
19 conditions.

20 JUDGE GARRIS: And that was just an example of your point
21 of reference?

22 MR. KELBER: That's all we have, yeah. It's not a direction
23 that you must use that but if you're looking for speed in a processing line
24 like this and Yasushi is dedicated to that prospect, don't stop it so you can
25 take a measurement.

26 You are going to use RTP. Wolf makes that point. And if
27 you're going to use RTP you're going to use at least 900 to 1050 degrees C.

1 So I think while it's an example it's consistent with what if
2 Yasushi were a fuller specification the inventor who taught it. Certainly
3 consistent with what those of skill in this particular art would draw.

4 That, okay, here's another teaching. The teaching of the claims
5 or the requirements of the claims and the teaching of the references we
6 observed at the outset today are very, very close.

7 JUDGE KRATZ: And what you're talking about, by the way,
8 in that section of USEF is the -- you're talking about the re-oxidation and
9 not the nitridation?

10 MR. KELBER: Not the nitridation.

11 JUDGE GARRIS: And the nitridation step was, the difference
12 was temperature that you were referring to earlier with respect to Yasushi
13 teaching that if you want to use a lower nitridization temperature?

14 MR. KELBER: I'm sorry, it's Bensahel that teaches.

15 JUDGE GARRIS: Bensahel teaches that but it's not the re-
16 oxidation.

17 MR. KELBER: Yes.

18 JUDGE GARRIS: So you're trying to compare the RTP for the
19 one, the nitrating step with the RTP for the re-oxidation step?

20 MR. KELBER: I'm not trying to compare them but it's the
21 next step in line. The same temperature conditions are going to be there.

22 If you read USEF and Wolf the RTP conditions are applied to
23 both conventionally, are applied to both nitriding and re-oxidation.

24 JUDGE GARRIS: So you wouldn't -- you're saying that you
25 wouldn't use -- if you were going to use RTP for the re-oxidation then you
26 would have used RTP for the nitriding?

1 MR. KELBER: That's correct. You would not use it but in
2 different special situation particularly --

3 JUDGE GARRIS: You would need a different tool; is that the
4 problem?

5 MR. KELBER: I'm sorry?

6 JUDGE GARRIS: You need a different tool?

7 MR. KELBER: You need a different tool. You need a
8 minimum but you need a cooling step in your line. You're either moving
9 from one tool to the other or you're stopping.

10 And now these are chemical processes that are not definite end
11 points. So if you -- if your nitriding conditions are heat sensitive and you
12 apply too much heat you're going to get the problems that Bensahel suggests
13 you're going to get.

14 You're not going to nitride and then immediately step to a
15 higher heat condition because they're still going to affect that layer.

16 So if it's a nitrous -- nitric oxide layer that's elevated to a
17 higher heat you're still going to run into the same problem. There is no
18 chemical treatment or modification between nitriding and if you will, re-
19 oxidation.

20 And that's why in Bensahel although it doesn't deal with re-
21 oxidization and it wasn't an object they are aware of RTP and they teach
22 away from it.

23 And that's at column one, line -- the paragraph beginning at
24 about line 37 which specifically says, well, the prior teaches you to make a
25 nitrided layer.

26 Not re-oxidation alone but to make a nitrided layer use RTP.
27 Don't do that. I think it's a fair conclusion reflected of those of skill in the

1 art that Bensahel is a teaching to stay away from RTP when you're
2 manipulating or processing nitrided layers.

3 JUDGE GARRIS: Okay, but there's been advances made in
4 the RTP process where maybe it's more acceptable now, right, because they
5 haven't conducted subsequent to this reference being; is that true?

6 Is that what the -- is that what the other reference in the
7 beginning was relying on for the --

8 MR. KELBER: The Li reference or Wolf?

9 JUDGE GARRIS: Wolf.

10 MR. KELBER: Well, Wolf comes along and says RTP is great,
11 it's the dominant process, here's where you use it, here's where you don't.

12 If you look at an item in paragraph three of the critical page,
13 you learn that RTP is consistent with short processing times and that's page
14 309.

15 JUDGE GARRIS: Right.

16 MR. KELBER: So you've got one set of references, the
17 Yasushi, Li, USEF, all talking about if you use modern high speed, high
18 temperature processing here's what happens.

19 And you've got a reference, Bensahel that says, don't do that; I
20 know all about RTP which Wolfe says is the dominant way to do it. I want a
21 much slower, much lower processing temperature.

22 Okay, then that's a choice you make but you make it with the
23 intended ills and one of them is you teach away from the claimed invention
24 which wants to get to the goal in a processing line, not in a much slower
25 cooler environment with a different tool.

26 Thank you, gentlemen. I appreciate the opportunity.

27 JUDGE GARRIS: Any other questions?

1 JUDGE COLAIANNI: No questions.

2 JUDGE GARRIS: Thank you very much, sir. I appreciate your
3 help here.

4 Whereupon, the hearing was concluded at 2:10 p.m.